STUDENT ID NO

MULTIMEDIA UNIVERSITY

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FINAL EXAMINATION

TRIMESTER 3, 2022/2023 (TERM ID 2230)

DMA5201 – Mathematical Techniques-2 (TC1L/TT1L)

06th October- 2023
9.00 A.M – 11.00 A.M
(2 Hours)

INSTRUCTIONS TO STUDENTS

1.This question paper consists of 7 printed pages (inclusive of the cover page)

2.Answer **ALL** questions. The distribution of marks for each question is given.

3.Please write all your answers in the **Answer Booklet** provided.

4.Please write the answers for each question on a new page.

5.Key formulas are provided at the appendix

Question 1[10 marks]

(a) Calculate the following limits

(i) $\lim_{x\to 2}\dfrac{x^2-9}{x-3}$

(ii) $\lim_{x\to 0}\dfrac{3}{\sqrt{3x+1}+1}$

[2 + 2 = 4 marks]

(b) Examine the continuity of the function at $x = 3$

$$f(x)=\begin{cases}\dfrac{x+2}{3} & x<3\\ \dfrac{12-3x}{3} & x\geq 3\end{cases}$$

[3 marks]

(c) Find the derivative for the function given below

(i) $w=3z^{-3}-\dfrac{1}{z}$

[1.5 marks]

(ii) If $y=x^3-3x^2+3\pi^2$, Find $\dfrac{d^2y}{dx^2}$

[1.5 marks]

Continued...

Question 2[10 marks]

(a) Evaluate the following integrals

(i) $\int_0^2 \left(x^3 - 3x^2 + 2x\right)dx$

(ii) $\int \left(4x^{-2} + 7x^{-3}\right)dx$

[2 + 2 marks]

(b)

(i) Find the critical numbers of $f(x) = 2x^3 - 3x^2 - 12x + 5$

[1.5 marks]

(ii) Find the local maxima and local minima of the function $f(x) = x^2$

[1.5 marks]

(c) Evaluate the integral by parts

(i) $\int x^2 \ln x dx$

[1.5 marks]

(ii) Evaluate the integral by substitution method

$\int x^3 \left(x^4 + 1\right)^{-2/3} dx$

[1.5 marks]

Continued...

Question 3[10 marks]

(a) Find the area of the region enclosed by $x = y^2$ and $y = x - 2$, integrating with respect to y.

[3 marks]

(b) Find the volume of the solid that is obtained when the region under the curve $y = \sqrt{x}$ over the interval [0 , 1] is revolved about the x – axis.

[3 marks]

(c) What is the order of the differential equation whose solution is the circle $(x-\alpha)^2 + y^2 = \alpha^2$, where α is an arbitrary constant.?

[4 marks]

Continued...

Question 4[10 marks]

(a) Solve the differential equations by variable separable method

(i) $x^2(y+1)dx+y^2(x-1)dy=0$

(ii) $\sqrt{(1-x^2)}dy+\sqrt{(1-y^2)}dx=0$

[3 + 1 marks]

(b)

(i) Find the 20th and 35th terms of the series 38, 36, 34, …

[1.5 marks]

(ii) Write the first three terms of the sequence whose general term is $\frac{(-1)^{n+1}}{2^{n+1}}$

[1.5 marks]

(c)

(i) Find the 8th term of the series $-\frac{1}{3},\frac{1}{2},-\frac{3}{4},...$

[1.5 marks]

(ii) Sum the series $81,54,36,...$ to 9 terms

[1.5 marks]

End of Questions.

Appendix

Differentiation Formula

(i) Derivative of a constant

$$\frac{d}{dx}(c)=0$$

(ii) Power function

$$\frac{d}{dx}\left(x^n\right)=nx^{n-1}$$

(iii) Constant Multiple Rule

$$\frac{d}{dx}[cf(x)]=c\frac{d}{dx}[f(x)]$$

(iv) Sum and Difference Rule

$$\frac{d}{dx}[f(x)\pm g(x)]=\frac{d}{dx}[f(x)]\pm\frac{d}{dx}[g(x)]$$

(v) Product Rule

$$\frac{d}{dx}[f(x).g(x)]=f(x)\frac{d}{dx}[g(x)]+g(x)\frac{d}{dx}[f(x)]$$

(vi) Quotient Rule

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right]=\frac{g(x)\frac{d}{dx}[f(x)]-f(x)\frac{d}{dx}[g(x)]}{[g(x)]^2}$$

Integration Formula

(i) $\int x^n dx=\left(\frac{x^{n+1}}{n+1}\right)$

(ii) $\int\frac{dx}{x}=\log x$

(iii) $\int\sin x dx=-\cos x$

(iv) $\int\cos x dx=\sin x$

(v) $\int\tan x dx=\log\sec x$

(vi) $\int\cot x dx=\log\sin x$

Arithmetical Progression

(i) $S=\frac{n}{2}(a+l)$

(ii) $l=a+(n-1)d$

(iii) $S=\frac{n}{2}\{2a+(n-1)d\}$

Geometrical Progression

(i) The nth term of geometrical progression is

$l=ar^{n-1}$

(ii) The sum of number of terms in geometrical progression

$S=\frac{a(r^n-1)}{r-1}$ and $S=\frac{a(1-r^n)}{1-r}$

(iii) sum to infinity in geometrical progression

$S=\frac{a}{1-r}$